REMARKS

Status of Claims:

Claims 1, 3, 7, and 9 are cancelled. New claim 13 is added. Thus, claims 2, 4-6, 8, and 10-13 are present for examination.

Specification:

The specification has been amended to correct some minor informalities.

Claim Rejection Under 35 U.S.C. 101:

Claims 1-12 are rejected under 35 U.S.C. 101 because the Examiner asserts that the claimed invention is directed to non-statutory subject matter.

Claims 1, 3, 7, and 9 have been cancelled. With respect to claims 2, 4-6, 8, and 10-12, as amended, the rejection is respectfully traversed.

The Examiner states that, "[i]f the 'acts' of a claimed process manipulate only numbers, abstract concepts or ideas, the acts are not being applied to appropriate subject matter." The Examiner further states that, "a process consisting solely of mathematical operations, i.e., converting one set of numbers into another set of numbers, does not manipulate appropriate subject matter and thus cannot constitute a statutory process." (Office Action; page 2).

First, it should be noted that the claims fall within enumerated statutory categories. Independent claim 2 and its dependent claims recite a "device" and, thus, fall within the enumerated statutory category of a "machine". (35 U.S.C. 101). Independent claim 8 and its dependent claims recite a "method" and, thus, fall within the enumerated statutory category of a "process". (35 U.S.C. 101).

Second, as stated in MPEP § 2106 IV B 2 (a), "[a] claim limited to a machine or manufacture, which has a practical application in the technological arts, is statutory." (Emphasis Added). Also, as provided in MPEP § 2106 IV B 2 (b), a process that provides a

practical application within the technological arts is statutory. Moreover, it should be noted that the transformation of data through a series of mathematical calculations that produces a useful, concrete, and tangible result is a practical application of a mathematical calculation. (*State Street Bank & Trust Co. v. Signature Financial Group, Inc.*, 149 F.3d 1368, 1373 (**Fed. Cir.** 1998)). A result may be useful, concrete, and tangible **even if the result is expressed in numbers**. (*State Street Bank*, 149 F.3d at 1375).

The present claims allow for calculating outlier scores and change point scores for data. The outlier scores and change point scores are useful, concrete, and tangible results as they may be relied upon in technological fields such as machine learning, data mining, and others. (Specification; page 1, lines 18-27; page 3, lines 10-14;). For instance, consider the example provided in applicant's FIG. 10 and discussed at page 25, lines 4-23 of the specification. In the example, the daily data of the Tokyo Stock Price Index were analyzed to obtain change point scores for the data. (Specification; page 25, lines 8-13). Then, in the example, it was understood that the change point score was high for the so-called Black Monday and in the period of generation and collapse of the bubble economy. (Specification; page 25, lines 18-23).

Thus, the outlier scores and change point scores are useful, concrete, and tangible results even though they may be expressed in numbers. (*State Street Bank*, 149 F.3d at 1375). As such, claims 2, 4-6, 8, and 10-12, provide practical applications within the technological arts and, therefore, the claims are statutory. (MPEP § 2106 IV B 2 (a) and § 2106 IV B 2 (b)). Furthermore, it should be noted that independent claim 8 has been amended to recite that the claimed outlier and change point detection method is "used for machine learning or data mining".

Claim Rejection Under 35 U.S.C. 102:

Claims 1-12 are rejected under 35 U.S.C. 102(b) as being anticipated by Biliris et al. (U.S. Patent No. 6,055,491) (hereinafter Biliris).

Claims 1, 3, 7, and 9 have been cancelled. With respect to claims 2, 4-6, 8, and 10-12, as amended, the rejection is respectfully traversed.

Independent claim 2, as amended, recites an outlier and change point detection device for calculating outlier scores and change point scores for data described with a sequentially input discrete variate and/or continuous variate so as to allow for detection of outliers and change points of said data, said outlier and change point detection device comprising:

> "a first time-series model learning device for learning a probability distribution of the data as a time-series statistic model specified by a finite number of parameters;
>
> an outlier score calculator for reading the parameters obtained through learning by said first time-series model learning device, and for calculating an outlier score of the data based on the read parameters of the time-series statistic model and the input data, and for outputting the outlier score;
>
> a moving average calculator for sequentially reading each outlier score calculated by said outlier score calculator, and for calculating a moving average of the read outlier scores;
>
> a second time-series model learning device for sequentially reading each moving average of the read outlier scores calculated by said moving average calculator, and for learning a particular probability distribution for the read moving averages as a particular time-series statistic model specified by a finite number of particular parameters; and
>
> a change point score calculator for reading the particular parameters obtained through learning by said second time-series model learning device, and for calculating a particular outlier score for each moving average calculated by the moving average calculator based on the read particular parameters of the particular time-series model and the moving average calculated by the moving average calculator, and for outputting the particular outlier score for each moving average as a change point score of the data." (Emphasis Added).

An outlier and change point detection device including the above-quoted features has at least the advantages that: (i) a first time-series model learning device allows for learning a probability distribution of data as a time-series statistic model specified by a finite number of parameters; (ii) an outlier score calculator allows for calculating an outlier score of the data based on read parameters of the time-series statistic model and the input data; (iii) a moving average calculator allows for sequentially reading each outlier score calculated by the outlier score calculator, and for **calculating a moving average of the read outlier scores**; (iv) a second time-series model learning device allows for learning a particular probability

distribution for read moving averages as a particular time-series statistic model specified by a finite number of particular parameters; and (v) a change point score calculator allows for **calculating a particular outlier score for each moving average** calculated by the moving average calculator based on read particular parameters of the particular time-series model and the moving average calculated by the moving average calculator, and for outputting the particular outlier score for each moving average as a change point score of the data. (Specification; page 18, line 13 to page 22, line 6; FIGs. 3-5).

Biliris neither discloses nor suggests an outlier and change point detection device including the above-quoted features for at least the following two reasons.

First, Biliris neither discloses nor suggests an outlier and change point detection device with a moving average calculator for sequentially reading each outlier score calculated by an outlier score calculator, and for **calculating a moving average of the read outlier scores**. Instead, in the system of Biliris, outliers are merely reported as anomalies or interesting events to a monitor device and are not used in any further calculations in the device of Biliris. (Biliris; column 7, lines 3-16). The Examiner states that, "a linear regression can be considered as a moving average since it uses past data to generate a projection of the behavior of the data". (Office Action; page 4). However, even if a linear regression could be considered as a moving average, it would meaningless with respect to whether or not Biliris calculates a moving average of outlier scores, because the outlier scores determined by the device of Biliris are not subject to linear regression by the device of Biliris. (Biliris; column 7, lines 3-16; column 11, lines 19-41; column 12, lines 13-15).

The process illustrated in FIG. 2 of Biliris allows for receiving a plurality of co-evolving time sequences (step 100), assigning missing data of a delayed time sequence as a dependent variable (step 120), assigning present values of known time sequences and past values of known and delayed time sequences as independent variables (step 130), forming an equation from the dependent and independent variables and solving the equation using the least squares method (step 140), and reconstructing the missing data for the delayed time sequence using the solved equation (step 150). (Biliris; FIG. 2; column 11, lines 19-42). It is important to note that the device of Biliris does not use outlier scores when solving the

equation using the least squares method in step 140. (Biliris; column 5, line 51 to column 6, line 7).

Indeed, the device of Biliris is not able to detect an outlier until after the missing data for the delayed time sequence is determined in step 150 and after actual data for the predicted missing data is received, because Biliris determines outliers by calculating a difference between the predicted value and the actual value. (Biliris; column 7, lines 3-16). This is confirmed by the claims of Biliris, where Biliris states that a step (g) provides outlier detection, and the step (g) occurs after step (f) in which an equation is solved using a least squares method. (Biliris; column 11, lines 19-42; column 12, lines 13-15). Thus, the outlier scores determined by the device of Biliris are not subject to linear regression by the device of Biliris. (Biliris; column 7, lines 3-16; column 11, lines 19-41; column 12, lines 13-15).

Second, Biliris neither discloses nor suggests an outlier and change point detection device with a change point score calculator for **calculating a particular outlier score for each moving average** calculated by a moving average calculator based on read particular parameters of a particular time-series model and the moving average calculated by the moving average calculator, and for outputting the particular outlier score for each moving average as a change point score of input data. The Examiner points to column 11, lines 19-41 and column 12, lines 10-15, of Biliris and states that, "correlation measures the change between data points". (Office Action; page 5).

However, the correlation in the device of Biliris does not measure changes between data points but, rather, detects relationships between one time sequence of data and another time sequence of data. (Biliris; column 2, lines 1-5; column 10, lines 19-56; FIGs. 8A-8B). Moreover, the device of Biliris certainly does not calculate **outlier scores for moving averages of outlier scores**, because the device of Biliris does not even calculate moving averages of outlier scores as was pointed out in the above remarks.

Therefore, independent claim 2, as amended, is neither disclosed nor suggested by the Biliris reference and, hence, is believed to be allowable.

Independent claim 8, as amended, recites an outlier and change point detection method with features similar to features of an outlier and change point detection device of independent claim 2 and, thus, is believed to be allowable for at least the same reasons that independent claim 2 is believed to be allowable.

The dependent claims are deemed allowable for at least the same reasons indicated above with regard to the independent claims from which they depend.

New independent claim 13 recites features that are not found in the Biliris reference.

Conclusion:

Applicant believes that the present application is now in condition for allowance. Favorable reconsideration of the application as amended is respectfully requested.

The Examiner is invited to contact the undersigned by telephone if it is felt that a telephone interview would advance the prosecution of the present application.

The Commissioner is hereby authorized to charge any additional fees which may be required regarding this application under 37 C.F.R. §§ 1.16-1.17, or credit any overpayment, to Deposit Account No. 19-0741. Should no proper payment be enclosed herewith, as by a check being in the wrong amount, unsigned, post-dated, otherwise improper or informal or even entirely missing, the Commissioner is authorized to charge the unpaid amount to Deposit Account No. 19-0741.

If any extensions of time are needed for timely acceptance of papers submitted herewith, Applicant hereby petitions for such extension under 37 C.F.R. §1.136 and authorizes payment of any such extensions fees to Deposit Account No. 19-0741.

Respectfully submitted,

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By Justin Sobaje

FOLEY & LARDNER LLP
Customer Number: 22428
Telephone: (310) 975-7965
Facsimile: (310) 557-8475

Justin M. Sobaje
Attorney for Applicant
Registration No. 56,252